What is claimed is:

1. A small-signal optical parametric amplifier (OPA) comprising:

a narrowband pump source, wherein the narrowband pump source produces a pump output;

means for suppressing stimulated Brillouin scattering (SBS), coupled to the narrowband pump source;

a booster amplifier, coupled to the SBS-suppressed pump output, wherein said booster amplifier amplifies said SBS-suppressed pump output to a sufficient power level for achieving parametric gain;

a bandpass filter, coupled to the booster amplifier, wherein the bandpass filter bandpass filters the amplified, SBS-suppressed pump output and suppresses amplified spontaneous emission (ASE) in the pump output;

a low-loss coupler, coupled to the bandpass filter and the receiving end of a small-signal transmission line, wherein said low-loss coupler couples the filtered, amplified, SBS-suppressed pump output with a small-signal received from the small-signal transmission line; and

means for performing non-linear mixing, coupled to the injection coupler, wherein the non-linear mixing means parametrically amplifies the small-signal with the filtered, amplified, SBS-suppressed pump output to produce an amplified output signal.

2. The OPA of claim 1 wherein said means for suppressing SBS comprises phase modulator.

3. The OPA of claim 1 wherein said booster amplifier comprises an erbium-doped fiber amplifier (EDFA).

4. The OPA of claim 1 wherein said means for performing non-linear mixing comprises a highly non-linear fiber (HNLF).

5. The OPA of claim 1 wherein said low-loss coupler is an injection coupler.

6. The OPA of claim 1, further comprising:

a high-power filter, coupled to said non-linear mixing means, wherein the high-power filter filters the amplified output signal to provide pump isolation.

7. The OPA of claim 6, wherein the high-power filter includes a coarse wavelength division multiplexer (CWDM).

8. The OPA of claim 2, further comprising:

a noise-source, coupled through a low-pass filter to an input of said, phase-modulator wherein the noise-source provides noise to said phase-modulator in order to suppress SBS.

9. The OPA of claim 8, wherein the noise-source is a Gaussian noise-source.

10. The OPA of claim 1, wherein said bandpass filter includes three fused coarse wavelength division multiplexers (CWDMs) in series.

11. The OPA of claim 1, wherein said low-loss coupler includes a four-channel fused CWDM.

12. The OPA of claim 1 coupled to a narrowband filter, wherein the narrowband filter filters the amplified output signal.

13. The OPA of claim 1, wherein said means for performing non-linear mixing has a length (L) between 500 to 1500 meters long.

14. The OPA of claim 1, wherein the narrowband pump source is a fiber laser.

15. The OPA of claim 1, wherein the filtered, amplified, SBS-suppressed pump output has a pump power of between 0.22 W and 0.71 W at an input of said means for performing non-linear mixing.

16. The OPA of claim 1, wherein the amplified output signal has a signal strength of approximately –25 dBm.

17. A method for parametrically amplifying a small-signal, comprising:

generating a narrowband pump output;

suppressing stimulated Brillouin scattering (SBS) in the narrowband pump output;

amplifying the SBS-suppressed pump output to a sufficient power level for achieving parametric gain;

bandpass filtering the amplified, SBS-suppressed pump output, wherein the bandpass filtering suppresses amplified spontaneous emission (ASE) in the pump output;

coupling the filtered, amplified, SBS-suppressed pump output with a small-signal received from a small-signal transmission line; and

parametrically amplifying the small-signal with the filtered, amplified, SBS-suppressed pump output in a highly non-linear fiber (HNLF) to produce an amplified output signal.

18. The method of claim 17 wherein the SBS-suppression step comprises phase-modulating the narrowband pump output.

19. The method of claim 17 wherein amplifying step amplifies the SBS-suppressed pump output to approximately one (1) watt (W).

20. The method of claim 17, further comprising:

high-power filtering the amplified output signal to provide pump isolation.

21. The method of claim 17, wherein the SBS-suppression step includes:

providing noise from a noise-source;

low-pass filtering the noise; and,

phase-modulating the narrowband pump output with the low-pass filtered noise in order to suppress SBS.

22. The method of claim 21, wherein the providing noise step provides noise from a Gaussian noise-source.

23. The method of claim 17, wherein the amplifying step amplifies the SBS-suppressed output with an EDFA.

24. The method of claim 17, wherein bandpass filtering is performed by three fused fiber CWDM in series.

25. The method of claim 17, wherein coupling step is performed by an injection coupler that includes a four-channel fused CWDM.

26. The method of claim 17, further comprising:

narrowband filtering the amplified output signal.

27. The method of claim 17, wherein the parametrically amplifying step parametrically amplifies the small-signal with the filtered, amplified, SBS-suppressed pump output in an HNLF with a length (L) between 500 to 1500 meters long.

28. The method of claim 17, wherein the generating step generates the narrowband pump output with a fiber laser.

29. The method of claim 17, wherein the filtered, amplified, SBS-suppressed pump output has a pump power of between 0.22 W and 0.71 W.

30. The method of claim 17, wherein the parametrically amplifying step produces an amplified output signal that has a signal strength of approximately –25 dBm.

31. A method for making a small signal OPA, comprising:

identifying an input small-signal band to be amplified;

obtaining specifications for an available highly non-linear fiber (HNLF);

setting a length of the HNLF;

determining a minimum pump source power that will provide adequate gain for the length of HNLF;

calculating a range of pump wavelengths that will provide gain across the input small-signal band;

specifying pump source according to calculated pump wavelength range;

determining appropriate parameters for a noise source and phase modulator;

specifying a source for the input small-signal, a booster amplifier, an injection coupler, and high-power filter;

cutting the HNLF to the length set; and

constructing the small signal OPA, the constructing step coupling the pump source and noise source to inputs of the phase modulator, an output of the phase modulator to an input of the booster amplifier, an output of the booster amplifier and the input small-signal to inputs of the injection coupler, an output of the injection coupler to an input end of the HNLF, and an output end of the HNLF to an input of the high-power filter.

32. The method of claim 31, further comprising:

measuring a zero dispersion wavelength (λ_0) of the HNLF.

33. The method of claim 31, further comprising:

calculating or estimating a Brillouin gain threshold for the HNLF.

34. The method of claim 31, further comprising:

determining whether or not polarization control will be used.

35. The method of claim 31, wherein the setting the length of the HNLF includes determining whether a low-power or low-cost design is to be pursued and setting the length accordingly.

36. The method of claim 31, further comprising:

calculating how the small signal OPA will perform over an expected operating temperature range.

37. The method of claim 36, further comprising:

determining a packaging design for the small signal OPA, wherein the determining a packaging design step uses results of the calculating step.

38. The method of claim 31, further comprising:

modeling operation of the small signal OPA operation over an expected range of input small-signal variation; and,

making necessary adjustments to the small signal OPA based on the modeling to achieve desired results.